NONMONOTONE TEMPERATURE DEPENDENCE OF PLASMA DRIVEN PERMEATION IN NB MEMBRANE.

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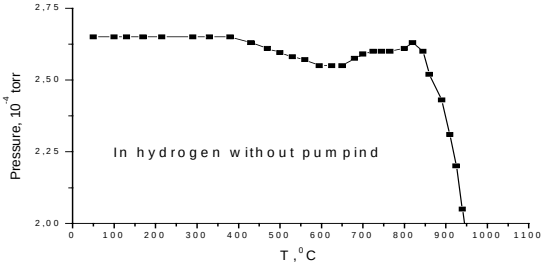
Permeation rate of hydrogen ions through Nb membrane have been investigated as a function of temperature under steady state condition. We are used two identical samples with 25 and 100 mkm thickness and with impurities less then 0.15%. The installation was described in details in [1] The strong temperature dependence at threshold of temperature ~400÷500 ^{0}C was detected for both samples (see fig. 1 and [1]).

The differences of thin and thick samples were observed. Maximum permeation efficiency of 25 mkm membrane is 25%. The maximum permeation efficiency of 100 mkm is 5÷6%. With increasing thickness the permeation efficiency decreased. The permeation growth time (time for getting steady state regime) for thicker sample is considerable more (at 100 times) then for another.

Experiments on sorption and desorption of molecular hydrogen was curried out in high vacuum chamber. It gives intensive desorption of hydrogen at 300÷400^{0}C. In the same temperature range was observed sorption in hydrogen atmosphere (see Fig. 2).

Observed phenomenon can't be described by use of existence theory of permeation which is based on difference of inlet and outlet surface potential barriers. Such behavior can be explained by taking into account the defects (dislocations, crystallites and $\beta \rightarrow \alpha$ phase transition).

To proof of this hypothesis acoustic diagnostic of the samples was curry out. The acoustic wave decrement sharp jump was observed at temperature 200^{0}C. This temperature is comparable with known temperature of the phase transition $\beta \rightarrow \alpha$ in Nb-H system [2].



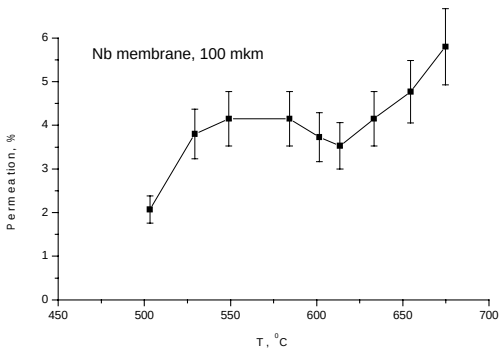


Fig.1 Permeation of hydrogen ions through NB membrane – 100 mkm.

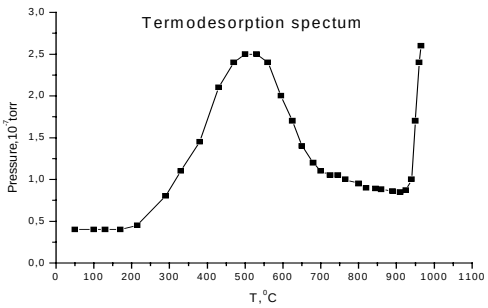


Fig.2 Sorption (up) and desorption (down) of molecular hydrogen by Nb membrane.

Reference:

1. **Skovoroda A.A. et al.** Plasma driven superpermeation through the Nb membrane at low temperature --, Hydrogen Recycle at Plasma Facing Materials, NATO Science Series, II. Mathematics, Physics and Chemistry, Vol.1, pp. 177-183, 2000
2. **Somenkov V.A, Shilshtain S.Sh.,** "Hydrogen phase transformation in metals", Moscow, 1978